

FOR CONTRACT No.: 04-4S0604

INFORMATION HANDOUT
MATERIALS INFORMATION

Storm Damage Recommendation
Dated September 28, 2010

Dist-Co-Rte-PM: 04-Santa Clara-85-0.3

Memorandum

*Flex your power!
Be energy efficient!*

To: MR. STEPHEN SAKATA
Senior, Central Region Design 1
Project Development

Date: September 28, 2010

Attention: M. Taketa

File: 04-SCL-85 PM 0.27
04 - 4S0600
Efis -04 0000 1203 0
Settlement

From: ^{AK} A. KADDOURA/M. ZABOLZADEH
Associate Material and Research Engineers
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

^{H. Nikouei} HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject : Storm Damage Recommendation

This memo is in response to your e-mail request dated August 12, 2010 for geotechnical recommendation for the settlement problems of the above referenced project. The project is located on northbound Route 85, just north of Bernal Road Undercrossing in the City of San Jose, Santa Clara County.

BACKGROUND/ EXISTING CONDITION

The existing PCC departure slab appears to be constructed sloping away from the structure towards north, while adjoining AC surface is constructed sloping towards the structure, creating a depression. This depression has settled a few inches (5"±) gradually through the past few years causing an undulation in the roadway. The roadway is constructed over 23 feet (tape measured) high fill embankment.

The settlement and crack area is about 100 feet long and about 66 feet wide, which extends from PCC departure slab to about 100 feet towards north covering the existing median shoulder and lanes number 1, 2 and 3. See attached Exhibit A.

According to our conversation with field maintenance crew, the settled area has not been AC overlaid in the past few years.

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SUBSURFACE INVESTIGATION

Four power borings (A-09-101 through A-09-104) were drilled at the project location to determine the cause for the roadway settlement in this area. One power boring (A-09-101) was drilled outside the settled area about 80 feet north of the existing DI in the median for comparison purposes. The other three borings (A-09-102, A-09-103, and A-09-104) were drilled in the settled area to assess the foundation condition. See attached Exhibit A for the locations of the borings.

Boring A-09-101 was drilled outside the settlement area into the embankment fill only to the depth of 16.5 feet below roadway surface to assess the condition of the embankment material. According to this boring, the embankment material is described as stiff to hard sandy lean clay with some gravel to the bottom of the boring. The SPT blow counts ranged between 28 and 42 blows per foot. Moisture content is not available at this time; however, the fill material appeared to be damp near the surface with increasing moisture with respect to depth at the time of our drilling. The unconfined compressive strength (measured with a pocket penetrometer) ranged between 2.0 tsf and 4.5 tsf.

Boring A-09-102 drilled above the existing Caltrans cross culvert to a depth of 6 feet (top of the culvert) in order to determine the quality and consistency of the fill material. Same fill material as boring A-09-101 was encountered with blow counts ranging between 18 and 29 blows per foot. The unconfined compressive strength (measured with a pocket penetrometer) ranged between 2.0 tsf and 2.5 tsf.

Boring A-09-103 was drilled at the worst section of the settled area to a depth of 36.5 feet below ground surface in order to assess the condition of both the embankment fill material and the foundation soils below it. The height of the embankment fill was tape measured to be about 23 feet at this location. Based on the boring A-09-103, the embankment fill materials are consistent with that of borings A-09-101, A-09-102, and A-09-104 (see below) to the depth of 23 feet near the original ground surface. However, the foundation soils below original ground surface can be described as medium stiff to very stiff sandy clay with much higher moisture content. The unconfined compressive strength (measured with a pocket penetrometer) ranged between 1.0 tsf and 3.0 tsf.

Boring A-09-104 was drilled near the perimeter of the settlement area (about 80 feet north of A-09-103) to the depth of 16.5 feet below ground surface for verification and for comparison purposes. This boring also revealed the same embankment fill materials as

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encountered in borings A-09-101 through A-09-103. The SPT blow counts ranged between 33 and 43 blows per foot.

The unconfined compressive strength (measured with a pocket penetrometer) for clayey materials encountered in Borings A-09-101, A-09-102 and A-09-104 ranged between 2.4 and more than 4.5 tsf.

Groundwater was not encountered in any of the borings.

CONCLUSIONS

Based on the above, we conclude the following:

- Based on Boring A-09-103, we believe post construction secondary foundation soil consolidation could be the primary cause of the settlement. As mentioned above, according to our conversation with field maintenance crew, the settled area has not been AC overlaid in the past few years and based on our periodic field visits during past year, the roadway condition at the settlement area appears to remain the same. This suggests that consolidation settlement may be completed.
- The PCC departure slab and the roadway are originally constructed sloping towards each other. This has created a depression at their joint. Physical evidence suggests that surface runoffs penetrate through the existing joint between the embankment fill and the PCC slab during rainy seasons softening the roadway embankment material. However, it is unclear whether or not; this water seepage has contributed to the settlement problem at this location. This is because the low moisture content (damp) of the soil samples retrieved from the borings does not confirm this. Regardless, this joint should be sealed and the depression needs to be corrected to prevent water seepage into the embankment.
- All the above borings suggests that the structural section of the roadway at the location of the settlement area has relatively competent foundation.

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RECOMMENDATIONS

We recommend correcting the profile between the PCC departure slab and the AC surfacing by lifting the PCC departure slab and the roadway at their joint. This can be achieved by using soil densification with expanded polyurethane material. Expanded polyurethane material (Permeation grouting) refers to the soil improvement technique of injecting under pressure a foam grout to densify and compact the surrounding soil or fill and lift structure. This high density expanded polyurethane foam with a nominal free rise density of 3 pounds will expand up to 20 times its original liquid form, exerting an upward anisotropic lifting force of approximately 3 kips per square foot.

The advantage of using this material is that it is an impermeable lightweight material, thus, it would act as a sealant at the joint eliminating the seepage problem.

According to our field measurement, a 2 inches PCC slab and about 1 inch AC pavement lifting may be necessary.

We recommend injecting polyurethane material by drilling 5/8-inch to 3/4-inch holes on approximate 4-foot centers. We recommend only one injection point per injection hole at the depth of 3 feet. The estimated number of injection holes is 135 (96 holes in the AC pavement and 39 holes in the PCC slab area). Refer to the attached Exhibit A for details.

For lifting purposes, one pound of polyurethane material is required to lift a 1 square foot area.

See attached Exhibit A for preliminary injection holes.

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It should be noted that the grout injection holes are subject to change during construction and may vary according to field conditions and the required lifting.

Injecting grout will create an uneven pavement surfacing. After completion of the grouting, we recommend grinding the AC surfacing at the location of the settled and cracked areas and resurface with AC.

If you have any questions or need additional information, please call Mohammad Zabolzadeh at (510) 286- 4831, Ali Kaddoura at (510) 286-4676 or Hooshmand Nikoui at (510) 286-4811.

- c: TPokrywka, HNikoui, MZabolzadeh, AKaddoura - (GS west), Mark Willian (GS Corporate), RE pending File (Structure Construction), John Stayton (DES OE), Brian Kearney (District ME), Steve Sakata (District 6 PM), Mark Taketa (District 6 PE)

MZabolzadeh/mm/4S0600-SCL-85-PM 0.27 Polyurethane Soil Densification



LOGGED BY AK	BEGIN DATE 4-1-09	COMPLETION DATE 4-1-09	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID A-09-101
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line) 34' Rt Sta 112+44	SURFACE ELEVATION 72.5 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG CS 2000 (truck)	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4")			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERI 84%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING 16.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
70.50	1		SANDY lean CLAY (CL); stiff; dark brown; moist; few fine, subrounded GRAVEL; some medium SAND; low plasticity fines; (fill).											
	2													
	3			1A	30	30	100				PP = 2.0			
68.50	4				15									
	5		At EL. 67.5 ft, becomes (SANDY lean CLAY) (CL); very stiff; (fill).	2A	6	28	100				PP = 3.5			
66.50	6		At EL. 66.5 ft, becomes (SANDY lean CLAY) (CL); hard; (fill).		14									
	7				14									
64.50	8			3A	14	37	100				PP = 4.0			
	9				15									
	10				22									
62.50	11			4A	10	34	100				PP = 4.5			
	12				14									
60.50	13				20									
	14			5A	10	36	100				PP = 3.0			
	15				16									
58.50	16		At EL. 57.5 ft, becomes (SANDY lean CLAY) (CL); very stiff; (fill).	6A	11	42	100							
	17				18									
56.50	18				24									
	19		Bottom of borehole at 16.5 ft bgs											
54.50	20													
	21													
52.50	22													
	23													
50.50	24													
48.50	25													

CALTRANS BORING RECORD MET-ENG FIXED EA4S0600.GPJ CALTRANS LIBRARY 040808.GLB 9/29/10



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Office of Geotechnical Design - West

REPORT TITLE BORING RECORD				HOLE ID A-09-101	
DIST. 04	COUNTY Santa Clara	ROUTE 85	POSTMILE 0.27	EA 04-4S0600	
PROJECT OR BRIDGE NAME NB SCL85 Bernal Rd UC					
BRIDGE NUMBER		PREPARED BY		DATE	SHEET 1 of 1

LOGGED BY AK	BEGIN DATE 4-1-09	COMPLETION DATE 4-1-09	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID A-09-102
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line) 44' Rt Sta 111+80	SURFACE ELEVATION 73.3 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG CS 2000 (truck)	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4")			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERI 84%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING 6.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
71.30	1		SANDY lean CLAY (CL); stiff; dark brown; dry; few subrounded GRAVEL; some medium SAND; low plasticity fines; (fill).												
	2														
	3				1A	13	18	90				PP = 2.5			
69.30	4					8	10								
	5		At EL. 68.3 ft, becomes (SANDY lean CLAY) (CL); moist; (fill).												
67.30	6				2A	15	14	100				PP = 2.5			
	7		Bottom of borehole at 6.0 ft bgs												
	8														
65.30	9														
	10														
63.30	11														
	12														
61.30	13														
	14														
59.30	15														
	16														
57.30	17														
	18														
55.30	19														
	20														
53.30	21														
	22														
51.30	23														
	24														
49.30	25														

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REPORT TITLE BORING RECORD				HOLE ID A-09-102	
DIST. 04	COUNTY Santa Clara	ROUTE 85	POSTMILE 0.27	EA 04-4S0600	
PROJECT OR BRIDGE NAME NB SCL85 Bernal Rd UC					
BRIDGE NUMBER		PREPARED BY		DATE	SHEET 1 of 1

LOGGED BY AK	BEGIN DATE 4-1-09	COMPLETION DATE 4-1-09	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID A-09-103
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line) 26' Rt Sta 111+90	SURFACE ELEVATION 73.0 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG CS 2000 (truck)	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4")			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERI 84%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING 36.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
71.00	1		SANDY lean CLAY with GRAVEL (CL); very stiff; dark brown; dry; little fine, subrounded GRAVEL; some coarse to medium SAND; (fill).												
	2														
	3														
69.00	4		At EL. 68.0 ft, becomes (SANDY lean CLAY with GRAVEL) (CL); moist; (fill).												
	5														
	6														
67.00	7														
	8														
	9														
65.00	10														
	11														
	12														
63.00	13														
	14														
	15														
61.00	16		At EL. 58.0 ft, becomes (SANDY lean to fat CLAY with GRAVEL) (CL/CH); hard; dry; (fill).												
	17														
	18														
59.00	19														
	20														
	21														
57.00	22														
	23														
	24														
55.00	25														

(continued)



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REPORT TITLE BORING RECORD				HOLE ID A-09-103
DIST. 04	COUNTY Santa Clara 85	ROUTE	POSTMILE 0.27	EA 04-4S0600
PROJECT OR BRIDGE NAME NB SCL85 Bernal Rd UC				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET 1 of 2	

CALTRANS BORING RECORD MET-ENG FIXED EA4S0600.GPJ CALTRANS LIBRARY 040808.GLB 9/29/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
47.00	25		Lean CLAY (CL); stiff; dark brown; moist; medium plasticity fines; (O.G.).	X	8A	3	10	100				PP = 1.0			
	26					4									
	27					6									
45.00	28														
	29														
43.00	30		At EL. 43.0 ft, becomes (Lean CLAY) (CL); very stiff.	X	9A	3	14	100				PP = 3.0			
	31					6									
	32					8									
41.00	33														
	34														
39.00	35														
	36			X	10A	3	10	100				PP = 3.0			
	37		Bottom of borehole at 36.5 ft bgs			4									
	38					6									
35.00	39														
	40														
33.00	41														
	42														
31.00	43														
	44														
29.00	45														
	46														
27.00	47														
	48														
25.00	49														
	50														
23.00	51														
	52														
21.00	53														
	54														
19.00	55														



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Office of Geotechnical Design - West

REPORT TITLE
BORING RECORD

HOLE ID
A-09-103

DIST.
04

COUNTY
Santa Clara

ROUTE
85

POSTMILE
0.27

EA
04-4S0600

PROJECT OR BRIDGE NAME
NB SCL85 Bernal Rd UC

BRIDGE NUMBER

PREPARED BY

DATE

SHEET
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LOGGED BY AK	BEGIN DATE 4-1-09	COMPLETION DATE 4-1-09	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID A-09-104
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line) 10' Rt Sta 112+20	SURFACE ELEVATION 72.7 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG CS 2000 (truck)	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4")			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERI 84%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER DURING DRILLING AFTER DRILLING (DATE) READINGS	TOTAL DEPTH OF BORING 16.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
70.70	1		SANDY lean CLAY (CL); dark brown; dry; little fine, subangular GRAVEL; some coarse to medium SAND; (fill).												
68.70	2														
66.70	3														
66.70	4														
	5														
66.70	6			X	1A	11 16 17	33	100							
	7														
64.70	8														
	9														
62.70	10			X	2A	12 16 18	34	100							
60.70	11														
	12														
58.70	13														
	14														
56.70	15			X	3A	6 17 18	35	100				PP = 2.25			
	16		At EL. 57.7 ft, becomes (SANDY lean CLAY) (CL); moist; (fill).												
	17		Bottom of borehole at 16.5 ft bgs												
54.70	18														
	19														
52.70	20														
	21														
50.70	22														
	23														
48.70	24														
	25														

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REPORT TITLE BORING RECORD				HOLE ID A-09-104	
DIST. 04	COUNTY Santa Clara	ROUTE 85	POSTMILE 0.27	EA 04-4S0800	
PROJECT OR BRIDGE NAME NB SCL85 Bernal Rd UC					
BRIDGE NUMBER		PREPARED BY		DATE	SHEET 1 of 1



